2.2

Power Functions with Modeling

Definition: Any function that can be written in the form

$f(x) = k \bullet x^{a}$, where k and *a* are nonzero constants, is a **power function**.

The constant *a* is the **power**. The *k* is the **constant of variation** or **constant of proportion.** We say $f(x)$ **varies as** the a^{th} power of *x* , or $f(x)$ **is proportional to** the a^{th} power of *x*.

Example: $A = \pi r^2$ the power is 2 and the constant of variation is π

Power function formulas with **positive powers** are statements of **direct variation**.

Power function formulas with **negative powers** are statements of **inverse variation**.

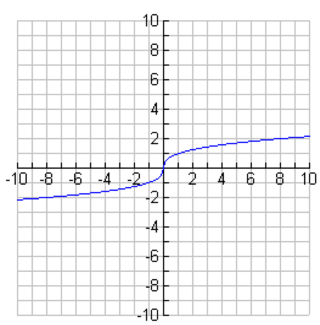
See pg. 188-189

Analyzing a Power Function:

Ex. State the power and constant of variation for the function, graph it, and analyze it.

$$f(x) = \sqrt[3]{x}$$

Because $f(x) = \sqrt[3]{x} = x^{\frac{1}{3}} = 1 \bullet x^{\frac{1}{3}}$, its power is 1/3, and its constant of variation is 1.



Domain: All reals

Range: All reals

Continuous

Increasing for all x

Symmetric with respect to the origin (odd)

Not bounded above or below

No local extrema

No asymptotes

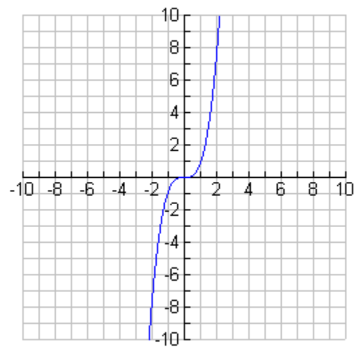
End Behavior: $\lim_{x \to -\infty} \sqrt[3]{x} = -\infty$ and $\lim_{x \to \infty} \sqrt[3]{x} = \infty$

Note: This is the inverse of X^3.

Definition of a monomial function – any function that can be written as f(x) = k or f(x) = k • x^n where k is a constant and n is a **POSITIVE INTEGER**.

The Cubing Function:

$f(x) = x^3$



Domain: All reals

Range: All reals

Continuous

Increasing for all x

Symmetric with respect to the origin (odd)

Not bounded above or below

No local extrema

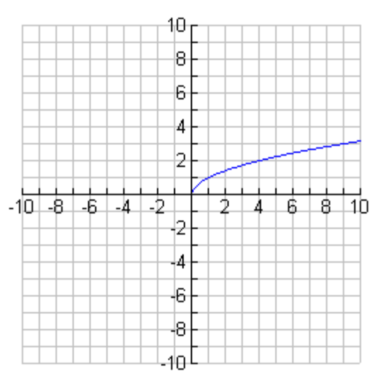
No asymptotes

End Behavior: $\lim_{x \to -\infty} x^3 = -\infty$ and $\lim_{x \to \infty} x^3 = \infty$

See pg. 192

The Square Root Function:

$f(x) = \sqrt{x}$



Domain: $\left[0, \infty\right)$

Range: $\left[0, \infty\right)$

Continuous on $\left[0, \infty\right)$

Increasing on $\left[0,\infty\right)$

No symmetry

Bounded below but not above

Local minimum at x = 0

No asymptotes

End Behavior: $\lim\limits_{x\to\infty}\sqrt{x}=\infty$